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Tradability of output and asset return cyclicality: Evidence from Europe

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Abstract

In this paper, I study the effect of *tradability*, defined as the amount of exports from the total output, on asset return cyclicality in European markets. Based on the analysis for years 2000-2017, I find that tradable sector is more exposed to systematic risk than the non-tradable sector, but no evidence that high tradability companies are more exposed to business cycles in particular. The study contributes to the vast literature in international trading and asset pricing, connecting the tradability as a firm's heterogenic character to asset pricing. Tradability is very unstudied aspect in asset literature, and the first study carried out in U.S. markets found it as a significant aspect affecting stock return cyclicality. This study focuses on EU countries, measuring the cyclicality of tradability sorted portfolios in 18 member states. Theory suggests that relative price adjustment mechanism affects the relative cash flows of tradable and non-tradable sector differently during economic shocks. I argue that this mechanism also affects the companies' stock returns respectively. To measure the tradability, I calculate a tradability figure for 56 industry categories, based on the proportion of exports to total output using international supply and use tables. The firm level tradability ratios are based on the tradability in sectors they produce output. I perform mean tests for the five tradability sorted portfolios and find an increasing and statistically significant pattern in average returns and standard deviation with relation to tradability. I also measure the exposure to GDP changes by calculating coefficients factors for each portfolio. Results show that high-tradability companies have more co-movement in returns with GDP growth than the low-tradability ones. However, after controlling for CAPM and Fama-French three factor models I find that most of the return patterns can be explained by common factors. An additional portfolio long on firms with high tradability and short on low-tradability cannot find return pattern related to business cycles in EU level.

After the analysis for the whole sample, I perform factor model analysis for stocks in country-level to see if tradability patterns are different in member states. Based on the country-specific tradability ratios, I find that German and Belgian stocks do not show growing asset return cyclicality with relation to tradability. French stocks produce significant results for the regression. The conclusion is that different trade patterns in EU countries expose different industries to supply and demand shocks emerging from outside and inside Europe.

Finally, I perform robustness checks to see if the tradability measurement is robust to the inclusion of imports as part of the tradability measurement. I find that portfolio changes remain modest after inclusion of imports as part of the tradability measurement. However, the pattern in GDP coefficient disappear. The result supports the conclusion that aggregate level tradability measurement do not reflect the tradable sector exporting to extra-EU countries.

Keywords business cycles, tradability, asset pricing

Contents

1. Introduction

This paper contributes to the vast literature of factor modeling in asset pricing. Zivot (2011) defined three different categories in factor modeling: macroeconomic, fundamental and statistical factor models are the most commonly used in asset pricing. An essential question in empirical asset pricing is the effect of company's fundamental characteristics on its stock returns (Tian, 2018). Looking into a rather unstudied field in asset pricing literature, this paper studies how the level of exports has affected firms' stock returns during 2000-2017 in European markets. The amount of goods exported abroad in relation to total output, referred as "tradability", has been found to be a statistically and economically significant attribute impacting stock return cyclicality in U.S. markets (Tian, 2018). I find that empirically asset return cyclicality is linked to the tradability also in the EU, but that the country-level trade differences have an effect in the exposure to business cycles.

The theoretical reasoning for the effect of tradability on asset return cyclicality is related to the concept of *relative price adjustment mechanism,* described in the chapter *2 Theoretical background and hypothesis*. The relative prices of tradable (consumable in domestic and foreign markets) and non-tradable (consumable only in domestic markets) goods change differently during demand and supply shocks, which affects the relative cash-flows and competitiveness of these sectors. I argue that in cases of negative supply or demand shocks, the relative prices increase more in the tradable sector compared to non-tradable sector and reduce the relative profitability of high-tradability companies. Eventually, this shows as a negative stock return difference between high- and low-tradability firms. During positive supply and demand shocks the relative price adjustment mechanism works the other way around: relative cash flows of tradable sector increase resulting higher stock returns. The hypothesis is that this mechanism makes tradable sector asset returns more cyclical compared to non-tradable sector.

The data and methodologies used in analysis are described in the third chapter. I measure the effect of tradability in returns by forming five tradability sorted portfolios for each year of the sample period. The level of foreign trade on an industry is the proportion of exports relative to the total output. Firm-level tradability is then calculated as a weighted average of tradability in the most relevant sectors where the company produces output. The monthly returns of these five portfolios are linked in to business cycles with three alternative methods: I use simple mean tests, factor model testing and GDP coefficients to evaluate the cyclicality of portfolio returns. An additional high- minus low-tradability portfolio (*TMNT)* is added to analyze the return difference of the most tradable and non-tradable stocks during expansion and recession periods.

As empirical results (chapter 4), I find that high-tradability companies have more cyclical asset returns based on the means of value weighted portfolio returns during recession and expansion

periods. During recessions, in this paper defined as two consecutive quarters in real GDP in EU (Claessens & Kose 2009), the average portfolio losses increase with tradability. On the contrary, the average returns are higher and statistically significant for the most-tradable firms during expansion periods. However, the TMNT portfolio regressions do not provide significant results. Finding the connection between asset return cyclicality and tradability, I perform factor model tests for the sample to check up if the patterns are driven by common factors. The regression results show that most of the return differences can be explained by conditional CAPM and Fama-French three factors models, and no significant abnormal returns based on the models are found during recessions.

As a most direct way of measuring asset return cyclicality, I calculate GDP coefficients for the returns of tradability sorted portfolios compared to real GDP growth rates quarterly. I find that high-tradability portfolios have more cyclical asset returns than low-tradability ones. The effect of market, size and value factors cannot be still excluded based on the analysis. Finally, I perform country level portfolio return analysis for the three countries with that have a significant amount of intra-EU trading among each other. I find no significant under- or overperformance patterns for the tradability sorted portfolios in Germany or Belgium. The regression results for French stocks show significant evidence supporting the stronger asset cyclicality of high-tradability companies.

Finally, to evaluate the robustness of chosen methods, I examine how the inclusion of imports as part of tradability measurement affects the portfolio placements and GDP coefficients of the tradability sorted portfolios. I find that tradability measurement is robust for the use of the different method, though the increasing pattern in GDP coefficients disappear with new portfolios. Based on the robustness checks, I find that including imports increases the proportion of intra-EU trading as part of the tradability measurement, that doesn't reflect the exports oriented outside Single Markets and exposure to global business cyclicality. The industries with high proportion of exports to other member countries are not affected by the supply and demand shocks in foreign markets outside EU.

The primary finding in this study is that using aggregate trade measurements including intra-EU and extra-EU exports, the tradable sector stock returns are not found more cyclical, though more exposed to common risk factors such as market risk.

2. Theoretical background & hypothesis

2.1 Related literature

This study is related to the fields of asset pricing and international open macroeconomics. It links tradability as an attribute of firms' heterogeneity to international economics, suggesting that this rather unexplored characteristic could be significant in asset pricing.

Empirical asset pricing has largely examined the heterogenic characteristics affecting firms' stock returns and asset prices. Eugene F. Fama and Kenneth R. French (1993) introduced one of the best-known asset pricing models, arguing that the market, value and size factors determine the asset prices in efficient markets. Subrahmanyam (2010) concluded that at least 50 different variables had been used to predict stock returns. Some of them have been linked with business cycles: for example, Chordia and Shivakumar (2002) found that momentum profits can be explained by business cycles. The current literature has examined tradability mainly as a macroeconomically important factor. The relative price adjustment mechanism, which (described in 2.2 *Theory and hypothesis*) causes different adjustments in tradable and non-tradable sectors, has been studied in many classical papers: Salter (1959), Swan (1960), and Dornbusch (1980) have recognized the effect in their studies. Influence on labor choice, capital allocation and production have been studied by OECD Economic surveys (2012), Baxter (1995) and Crucini (2008), finding significant differences between tradable and non-tradable sectors.

There are not many studies about tradability as a distinctive characteristic in asset pricing. Touching on the features of the tradable and non-tradable goods, Gomes et. al. (2009) studied the durability of output as a heterogenetic characteristic, linking it to systematic risk of a company. Tian (2018) carried out the first study connecting tradability to asset pricing in United States by examining the returns of tradability sorted portfolios during expansion and recession periods. The study also included GDP beta analysis and examined if the returns of a high-minus-low portfolio could be used to predict exchange rates. In general, results were that tradability is an important aspect of firm heterogeneity and that stock returns of tradable sector are more cyclical than in the non-tradable sector in U.S. Tian found that a portfolio long on high-tradability companies and short on low-tradability ones could be used to predict changes in exchange rates and trade volumes. The evidence was not completely conclusive as the tradability sorted portfolios didn't show statistically significant patterns for average returns or factor model tests, although the returns of portfolio short on firms with lowest tradability and long on firms with the highest ratios could be explained by business cycles. This far, studies from other markets has not been carried out.

2.2 Theory and hypothesis

The theoretical background for measuring the cyclicality of stock returns depends on defining heterogenic factors that affect firm level returns differently along business cycles. In addition to the characteristics described before, I argue that tradability, defined as the level of exports of a firm's output, is an important heterogenous aspect affecting company's stock returns. The theory suggests that companies producing highly tradable goods are more exposed to international supply and demand shocks, leading to more cyclical stock returns than in the industries with low level of exports.

The underlying assumption for tradability's heterogeneous effects is that *relative price adjustment mechanism* influences the cash flows of tradable and not-tradable businesses differently. Lucas (1982) described the determination of prices with a two-country example: both countries produce two different products, one which is only consumable in domestic markets (non-tradable) and one that can be exported to foreign markets (tradable). The price of a non-tradable good is determined in the domestic markets, while a tradable good is affected by the aggregate supply and demand changes from both the domestic and foreign markets. I apply the relative price adjustment mechanism theory (Barro, R. 1972) together with the endowment economy of two countries; the equilibrium prices of tradable goods will react relatively less to domestic supply and demand shocks than for the non-tradable goods. In case of a negative supply shock, the domestic equilibrium price of tradable good increases more than for the non-tradable ones, leading to lower relative cash flows and consequently reduces the competency of the sector. On the contrary, negative demand shocks decrease the relative prices of tradable goods less and cause a similar effect in cash flows. During positive shocks the mechanism works vice versa. This paper argues that the mechanism also affects the stock returns similarly in high- and low-tradability sectors.

Based on the theoretical reasoning, I define one main hypotheses for the study. As stock returns fluctuate along with the economic business cycles, tradable sectors should outperform non-tradable sectors during expansion periods and underperform during recession. Using the definition for recession as two consecutive quarters of decline in real term gross domestic product (Claessens & Kose 2009), I argue that the most tradable sectors have low returns compared to sectors specialized in domestic markets particularly in the first half of 2003, during the great recession in 2008-2009 and 2013. The GDP co-movement of high-tradability companies is expected to be larger than with low-tradability companies during the sample period.

Hypothesis 1: The stock returns in tradable sector are more cyclical in relation to business cycles

3. Data & methodology

3.1 Data & sample construction

3.1.1 Sample construction and return data

The sample consists of listed companies from 18 EU countries, excluding companies operating in financial sector (based on Thomson Reuters Business Classification, TRBC). Both active and inactive companies are included to avoid the survivorship bias. The data is from Thomson Financial Datastream. Countries included in the sample are:
Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Republic of Ireland, Italy, Luxembourg, Netherlands, Poland, Portugal, Spain, Sweden and United Kingdom.

I use Datastream to retrieve monthly total Return Index (RI) data for each company. The total returns index reflects the theoretical growth in the value of a share, assuming the dividends are reinvested to purchase additional shares (Aalto University Department of Finance Database, 2016). The total return for a company for the month is the value of RI in the beginning of next month divided by the value for the same month. Data for company-level market values (equity) for portfolio return calculations and portfolio characteristics are also from Datastream, nominated in US dollars.

3.1.2 Tradability of output and firm specific tradability ratios

The tradability of each company in the sample is measured with a firm specific *tradability ratio*. The firm-level ratios are calculated using international supply and use tables and information of companies' business segments with the following method:

Tradability of output by industries. I use WIOD's 2002-2014 international supply and use tables (SUT's) to calculate the tradability of output for each industry (total of 56 combined industries based on ISIC rev. 4 classification), defined to be the value of exports over total industry output. Industry data from all 18 EU countries is used. I use the tables for years 2002, 2005, 2008, 2001 and 2014 to calculate average industry ratios for the sample period. The tradability of industry i is:

$$tradability\ (i) = \sum_{t=1}^{5} \frac{Exports_{i,t}}{TIO_{i,t}},$$

where $Exports_{t,i}$ is the total sum of exports for the industry i for the year t and $TIO_{i,t}$ is the total industry output for the industry i and year t (aggregate in all 18 EU countries).

The final industry tradability used is the average of annual tradability ratios weighted with the value of total output for the period. *Table 1* illustrates the large variation in tradability by listing the top and bottom five industries based on their tradability of output.

Table 1. *Top and bottom five of the tradability sorted industries.*

Table 1 reports industries with the most and least foreign trade based on their tradability, calculated as the ratio between the exports and total output for each industry measured in USD (data from WIOT 2000-2014). See *appendice 1* for industry classification and **appendix 2** for exchange rates used for country level table construction.

ISIC rev. 4	Industry description	Trad. Ratio
	Top five:	
C26	Manufacture of computer, electronic and optical products	0,98
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	0,90
C30	Manufacture of other transport equipment	0,82
H50	Water transport	0,80
C28	Manufacture of machinery and equipment n.e.c.	0,74
	Bottom five:	
P85	Education	0,0050
G45	Wholesale and retail trade and repair of motor vehicles and motorcycles	0,0045
L68	Real estate activities	0,0037
Q	Human health and social work activities	0,0025
T	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	0,0005

Firm specific tradability ratios and tradability sorted portfolios. I calculate tradability ratio for each company based on their segments of sales and tradability of industries described above. I use data from Thomson Reuters Worldscope via Datastream to get SIC product codes and sales for the three biggest segments for each company annually. The company-level tradability ratios for each year are then the average of industry tradability ratios, value-weighted by the product segment sales, measured in US dollars (see *appendice 2* for exchange rates). See *appendice 1* for the SIC-code to ISIC rev. 4 correspondence tables. Total of 535 companies remain with the sufficient data about the segments of output.

Companies are sorted in to five portfolios in ascending order based on their tradability ratios for the beginning of each year. “NT” (non-tradable) indicates the portfolio consisting of companies with the lowest tradability ratios and “T” (tradable) includes the firms with highest tradability ratios. *Table 2* provides information on the characteristics of tradability sorted portfolios, calculated every year for each portfolio and the averaged over the sample period.

Table 2. *Characteristics of tradability sorted portfolios.*

Table 2 provides information of the tradability sorted portfolios as average numbers from the sample period. Sample equity share describes the portfolio’s share of equity value compared to the whole sample. Market capitalization is calculated with annual data in millions of US dollars.

(2000-2017)	*NT*	*2*	*3*	*4*	*T*
Sample equity share	0,16	0,16	0,24	0,30	0,14
Tradability ratio:					
Min	0,0025	0,05	0,13	0,43	0,69
Max	0,0513	0,13	0,46	0,70	0,98
Median	0,0219	0,10	0,28	0,57	0,78
Mean (equal wt.)	0,0270	0,10	0,29	0,57	0,82
Market capitalization (millions, $):					

Median	1437,0	1113,0	1028,9	1366,9	667,4
Mean (equal wt.)	5269,8	5184,2	7595,8	9744,0	4359,1

3.2 Return tests for tradability sorted portfolios

3.2.1 Simple mean tests and conditional factor model testing

For the portfolio level analysis, I construct five tradability sorted portfolios for each year with the methodology described above; portfolio returns are calculated as the value-weighted excess returns for each month, rebalancing the portfolios in annual basis. I use annual company market capitalization from Datastream for the portfolio rebalancing (nominated in US dollars). Excess returns are defined as the investment total returns excess to the risk-free return; I use German long term (9-10 years) Government bond yields equivalent to monthly yield as risk free rate. In addition to measuring the excess returns of five tradability sorted portfolios, I include the "tradable minus not tradable" (TMNT) returns for the analysis, defined as the difference in returns between the portfolio with highest tradability (*T*) and the lowest tradability (*NT*).

I use simple mean tests (student's t test) for the portfolios to see if there is any pattern in average returns of the portfolios. After one sample mean testing, I control the returns for factor models to see if other factors than tradability drive the possible return patterns. The factor model testing is done on ordinary least square (OLS) basis, based on the conditionalizing two traditional asset pricing models, the three-factor model built by Eugene F. Fama and Kenneth R. French (1993) and Capital Asset Pricing Model.

Conditional Fama-French 3-factor model is the principal method of analysis:

$$R_{p,t} - r_{f,t} = \alpha_i + \alpha_{i,rec} * d_{rec,t} + \beta_p^M (R_{M,t} - r_{f,t}) + \beta_p^M (R_{M,t} - r_{f,t}) * d_{rec,t} + \beta_p^{SMB} (R_{SMB,t}) + \beta_p^{SMB} (R_{SMB,t}) * d_{rec,t} + \beta_p^{HML} (R_{HML,t}) + \beta_p^{HML} (R_{HML,t}) * d_{rec,t} + \varepsilon_t$$

where $R_{p,t} - r_{f,t}$ are the excess returns for the month, α_i indicates the model alpha for the month, $\alpha_{i,rec}$ indicates the recession alpha for the month, β_p^M is the market beta, $R_{M,t}$ is the market return, β_p^{SMB} and $R_{SMB,t}$ are the factor and return for the size effect for the month (Fama and French 1993), $\beta_p^{HML} and$ $R_{HML,t}$ are the factor return for the value effect for the month, $d_{rec,t}$ is the recession factor, equal to 1 in recession months and 0 otherwise and ε_t is the error term.

Recession months are defined as two consecutive quarters of decline in real term gross domestic product (Claessens & Kose 2009). The monthly data for Fama and French 3 factors is from Kenneth R. French database (French, 2018). I use the risk-free rate described before to calculate excess market returns instead of these estimations.

Conditional CAP regression model is as follows:

$$R_{p,t} - r_{f,t} = \alpha_i + \alpha_{i,rec} * d_{rec,t} + \beta_p^M (R_{M,t} - r_{f,t}) + \varepsilon_t$$

where the terms are defined as before.

3.2.2 GDP coefficient test for tradability sorted portfolios

The most simple and direct way to measure the cyclicality of asset returns is to compare them with the changes in an economic growth factor directly (not dependent on the definition of recession). I calculate the beta coefficient between the tradability sorted portfolios and GDP growth, which is measured in a quarterly level. For this I use quarterly returns for the portfolios to match the frequency of both samples. The GDP coefficients determine portfolio returns' exposure to changes in economic growth, in other words to business cycles. Regression model for GDP beta calculation is:

$$R_{p,t} = \alpha_i + \beta_p^{GDP}(G_{GDP,t}) + \varepsilon_t$$

where $R_{p,t}$ is the portfolio returns, α_i is the GDP alpha, β_p^{GDP} and $R_{GDP,t}$ are the GDP coefficient and growth factors and ε_t is the error term. GDP coefficient describes the parallel changes in portfolio returns and GDP growths in the during the sample period.

3.2.3 Intra-EU shocks and tradability sorted portfolios

As a final analysis of tradability effects, I measure the stock returns of tradability sorted portfolios in four EU-member states where the intra-EU trading is significant part of the total exports of the country. I create portfolios and tradability ratios on country level in the same method as before and use four sample countries that have most intra-EU trading between each other (Eurostat, 2018). Germany, Belgium and France are included in the analysis, while Netherlands is excluded because of small number of firms in the sample (firm-specific risk would affect too much in the analysis). See appendix 4 for detailed statistics of trading in the sample countries (Eurostat, 2018).

The regression analysis examines the stock returns exposure on a country level, using same CAPM and FF3 regression models than for the aggregate EU level analysis. This should explain the differences in tradability characteristics between member states, removing balancing effect of the relative price adjustment mechanism that like in domestic trading in the internal markets (described in section 2.2 *Theory and hypothesis)*. Country-level analysis accounts for the differences in tradability of sectors between member states, analyzing the link between the stock returns cyclicality and tradability in a single country.

4. Empirical results

4.1 Tradability sorted portfolio regression

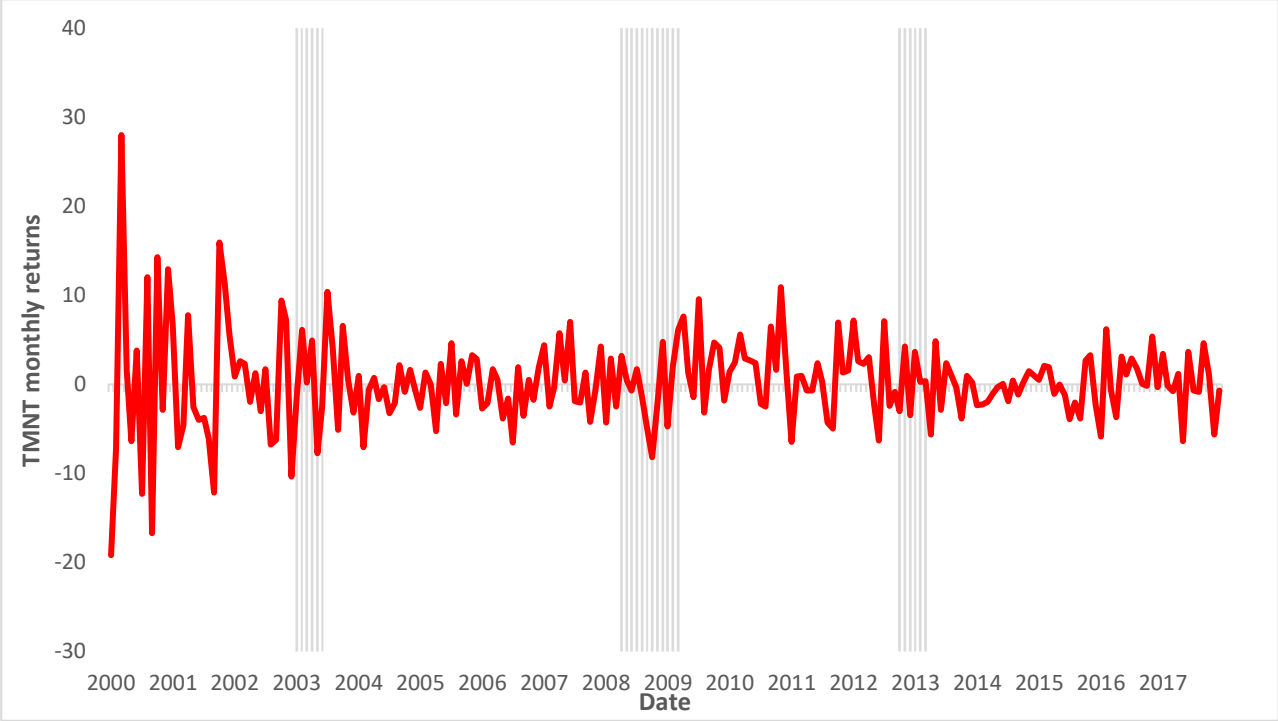
4.1.1 Simple mean test for tradability sorted portfolios

Period		*NT*	*2*	*3*	*4*	*T*	*TMNT*
2000-2017	Mean	0,46	-0,06	0,56’	0,50	0,76’	0,30
	std. dev.	5,55	6,92	5,69	6,13	7,85	5,12
		(1.22)	(-0,12)	(1,46)	(1.19)	(1.43)	(0,87)
2000-2017	Mean	0,71*	0,11	0,81*	0,82*	1,07*	0,35
(Expansion)	std. dev.	4,92	6,69	5,34	5,47	7,29	5,24
		(2,13)	(0,24)	(2,24)	(2.20)	(2,15)	(0.99)
2000-2017	Mean	-1,57***	-1,40***	-1,44***	-2,08***	-1,66***	-0,09
(Recession)	std. dev.	9,07	8,61	7,79	9,77	11,31	4,06
		(-2,55)	(-2,38)	(-2,72)	(-3,13)	(-2,16)	(-0,32)

Table 3. *Average returns of the tradability sorted portfolios*
Table 3 presents the average monthly returns, standard deviation and t-stats of tradability sorted portfolios, listed in ascending order of tradability (NT includes stocks with lowest tradability ratios and T the ones with high tradability). TMNT presents the average monthly difference between the returns of T and NT portfolios. Average returns are computed over the time period 2000-2017. T-statistics for the mean tests are presented in parenthesis.

Table 3 describes the average monthly excess returns (in percent) and standard deviation of tradability sorted portfolios. There is a weakly increasing pattern in average returns of portfolios, though only the results for portfolio 3 and T are statistically significant at 90% confidence interval. For the expansion months (not recession months), there’s statistically significant results for higher average returns for high tradability companies (not for *TMNT or 2* portfolios). The standard deviations also show weakly increasing pattern. Quantiles T, 3, 4 and T show statistically significant and increasing pattern in average returns during expansion periods. On the contrary, the recession periods (total of 24 recession months) show significant and weakly decreasing pattern in relation to tradability, indicating that on average the tradable sector underperforms compared to non-tradable sector during recessions. The interpretation is that based on average returns, more tradable firms outperform the less tradable ones during expansions and underperforms during recession but returns differences with the T and NT portfolios cannot be explained by business cycles. TMNT portfolios do not result statistically significant means for any market conditions, while the aggregate returns of TMNT portfolio for all of the three recession periods in the sample have been negative. *Figure 1* demonstrates the timing of recession periods and TMNT returns. Interesting is that the period of extremely high volatility in stock market returns (also for the TMNT portfolio) during the dot-com bubble in 2000 is not regarded as a recession period with the definition used.

Figure 1. *Monthly returns of TMNT portfolio*.
Figure 1 shows the monthly returns (in percent) of the portfolio long on high-tradability stocks and short on low-tradability stocks for 2000-2017. The returns are measured as value weighted average of quantile one (NT) and quantile five (T). The vertical lines present the recession months, defined as two consecutive quarters of real term GDP decline.



4.1.2 Factor model testing

I run factor model tests to see if the return patterns found are driven by common factors. The results from conditional factor model regressions are presented in the *table 4*.

Panel A represents the results from conditional Fama-French three factor model regression. In general, unconditional alphas are insignificant, with only *portfolio 4* having a significant alpha with 90% confidence interval. Conditional alphas, that indicate the abnormal returns of portfolios during recession periods, are also insignificant, and no consistent pattern related to tradability and recession period returns can be found, even though portfolios with higher tradability have had relatively lower returns during recession months. Also, the results indicate that there's no evidence for the hypothesis that high tradability companies (T) underperform low tradability companies (NT) during recessions or in general. See *appendice 3* for more detailed specification of the factor model coefficients. The significant unconditional FF3 coefficients and insignificant conditional FF3 coefficients suggest that the exposure to these factors do not depend on business cycle.

Panel B shows the results from conditional CAPM regression. Unconditional alphas are insignificant, except for the portfolio 2, that shows a significant negative underperformance of -0,52% in month (or -6,06% a year) with 95% confident interval. Yet the conditional alphas are all insignificant for the regression, there's no evidence of over- or underperformance for any portfolio during recession

periods. However, unconditional CAPM betas reveal a consistent risk pattern, with low tradability portfolios having lower (and statistically significant at 99,9% level) systematic risk coefficients than high tradability ones. Still with no evidence for unexplained returns during recession periods, the result implies that the stocks of companies operating in industries with more tradability tend to have carried more systematic risk and have been more exposed to market changes. The insignificant conditional market betas again prove that the exposure is not dependent on business cycles, except for NT and fourth portfolios, of which market dependency seems to decrease during recessions. Interesting is that the TMNT portfolio produces a significant positive beta of 0,31; changes in market returns have explained about a third of the difference between high tradability and low tradability portfolios' returns.

Table 4. *Factor model tests for tradability sorted portfolios*.

Table 4 presents the regression results of factor models for tradability sorted portfolios. Conditional FF-3 is the three-factor model developed by Eugene F. Fama and Kenneth R. French (1992) CAPM the capital asset pricing model, conditionalized with terms equal to one during recession periods and zero otherwise. T-statistics are presented in the parenthesis. The confidence intervals based on t-stats are: ':90% level, *:95% level, **:99% level, ***:99,9% level.

	NT	*2*	*3*	*4*	*T*	TMNT
Panel A:	Conditional FF-3 (2000-2017)					
α	0,25	-0,04	0,22	0,38'	0,51	0,36
	(1,36)	(-0,15)	(1,14)	(1,76)	(1,62)	(0,99)
conditional α	0,31	0,45	-0,01	-0,41	0,25	0,03
	(0,57)	(0,56)	(-0,01)	(-0,63)	(0,26)	(0,03)
Panel B:	Conditional CAPM (2000-2017)					
α	0,29	-0,52*	0,27	0,26	0,37	0,17
	(1,62)	(-1,77)	(1,33)	(1,20)	(1,16)	(0,48)
conditional α	0,24	0,96	-0,06	-0,28	0,38	0,23
	(0,44)	(1,07)	(-0,09)	(-0,43)	(0,38)	(0,21)
β	0,89***	1,09***	0,94***	0,97***	1,2***	0,31***
	(23,86)	(17,94)	(22,41)	(21,72)	(18,46)	(4,23)
Conditional β	0,16*	-0,08	-0,03	0,17'	0,11	-0,04
	(2,08)	(-0,65)	(-0,41)	(1,82)	(0,85)	(-0,32)

4.2 GDP betas for tradability sorted portfolios

GDP beta coefficients present the systematic effect of changes in real term GDP to portfolio stock returns. Regression results are presented in table 6. For example, the value of 2,93 for NT portfolio means that one percentage point increase in GDP growth has led to an average of 2,93 percentage point increase in the portfolio returns for the period. Results are significant with different confidence intervals, portfolio 2 and 3 regressions being significant with 90% portfolio 4 and T regression with 95% and portfolio NT with 99% confidence interval. High-tradability portfolios have higher GDP betas, indicating that the stock returns of high tradability sectors are more exposed to changes in economic growth factors. The effect of other fundamental characteristics cannot be excluded solely on the basis of GDP coefficients. The occurrence is not completely consistent, as the three lowest tradability portfolios have slightly decreasing beta coefficients, but also lower statistical significance. The TMNT portfolio does not produce statistically significant results and the tradable sector's under- or overperformance cannot be linked in to changes in GDP growth.

Table 5. *Cyclicality of tradability sorted portfolios*

Table 5 shows the GDP betas of tradability sorted portfolios, listed as before. GDP beta is the coefficient from regressing value weighted excess returns with explanatory variable of changes in real GDP in Euro area with an intercept term. Regression is done with quarterly figures. The confidence interval based on t-stats are: ':90% level, *:95% level, **:99% level, ***:99,9% level.

2000-2017	*NT*	*2*	*3*	*4*	*T*	TMNT
GDP β	2,93**	2,84'	2,09'	3,08*	3,43*	0,39
	(2,68)	(1,86)	(1,80)	(2,46)	(2,19)	(0,40)

4.3 Returns of tradability sorted portfolios by country

After the aggregate European level analysis with factor model testing and GDP coefficients, I perform factor model regressions for country level data in order to distinguish differences in the effects of tradability inside between EU countries. The results for Germany, Belgium and France are presented in the Tables 6.1-6.3.

Table 6.1 shows the Fama-French 3 factor model and CAPM regression results for tradability sorted portfolios in Germany. The FF3 regression provides evidence from German stocks' success in the sample period with five out of six portfolios producing significant alpha (in percent) at some confidence interval. NT portfolio does not have significant alpha. The TMNT portfolio has a positive and statistically significant unconditional alpha of 0,51 percent, indicating that the tradable sector has outperformed the non-tradable sector in general. Conditional alphas are mainly insignificant. NT portfolio creating a statistically significant recession alpha of 1,98 percent, indicating

overperformance during bad times in market based on the model. Nonetheless, the pattern is not monotonic and does not provide evidence from decreasing abnormal returns during recession periods. TMNT has negative yet not significant conditional alpha. FF3 beta coefficients suggest that market and size factors explain most of the changes in returns, showing a slightly increasing pattern. TMNT portfolio also has a statistically significant (99,9% confidence interval) market beta of 0,25, implying that the market movements explain one fourth of the return spread between low- and high tradability stocks. The conditional CAPM regression results are similar to FF3 regression, producing significant alpha for five portfolios. NT portfolio doesn't have significance at any confidence interval for regular alpha, but the regression produces a conditional alpha of 1,95 with 95% confidence interval that cannot be explained by the model. Significant conditional market betas show that exposure to market risk is depending on business cycles for portfolios NT (99% confidence interval), 3 (99,9%), 4 (95%) and T (99,9%) with smaller betas for the recession periods.

Table 6.*1* *Factor model tests for tradability sorted portfolios in Germany*

Table 6.1 presents the regression results of factor models for tradability sorted portfolios for German stocks. Conditional FF-3 is the three-factor model developed by Eugene F. Fama and Kenneth R. French (1992) CAPM the capital asset pricing model, conditionalized with terms equal to one during recession periods and zero otherwise. T-statistics are presented in the parenthesis. The confidence intervals: ':90% level, *:95% level, **:99% level, ***:99,9% level.

	Germany					
	NT	*2*	*3*	*4*	*T*	TMNT
	Conditional FF-3 (2000-2017)					
α	0,27	0,88***	0,58**	0,84***	0,78**	0,51'
	(-1,07)	(3,39)	(0,52)	(3,45)	(3,02)	(1,86)
conditional α	1,98**	0,17	1,04	0,40	0,96	-1,02
	(-2,63)	(0,22)	(1,59)	(0,55)	(1,25)	(-1,24)
β MKT	0,94***	1,04***	1,03***	0,95***	1,19***	0,25***
	(-18,41)	(19,76)	(23,11)	(19,24)	(22,63)	(4,41)
Conditional β MKT	0,27*	0,02	0,33**	0,09	0,45***	0,17
	(-2,35)	(0,17)	(3,22)	(0,77)	(3,74)	(1,36)
β SMB	0,52***	0,49***	0,24*	0,35**	0,70***	0,18
	(-4,40)	(4,08)	(2,34)	(3,06)	(5,77)	(1,40)
Conditional β SMB	-0,26	-0,28	-0,38	0,42	-0,90**	-0,64'
	(-0,83)	(-0,86)	(-1,42)	(-1,41)	(-2,82)	(-1,90)
β HML	-0,15'	-0,31**	0,27***	-0,05	-0,03	0,12
	(-1,65)	(-3,26)	(3,36)	(-0,51)	(-0,32)	(1,21)
Conditional β HML	0,25	0,90*	0,22	0,84*	0,01	-0,24
	(-0,70)	(2,41)	(0,69)	(2,41)	(0,04)	(-0,61)
R squared	0,7	0,7	0,8	0,7	0,8	0,2
	Conditional CAPM (2000-2017)					
α	0,31	0,83**	0,79***	0,90***	0,94***	0,63*
	(1,22)	(3,10)	(3,57)	(3,71)	(3,48)	(2,33)
conditional α	1,95*	0,26	0,85	0,37	0,80	-1,15
	(2,48)	(0,31)	(1,26)	(0,50)	(0,97)	(-1,40)
β	0,91***	0,99***	1,04***	0,93***	1,15***	0,25***
	(17,12)	(17,93)	(22,83)	(18,57)	(20,77)	(4,46)
Conditional β	0,33**	0,16	0,40***	0,23*	0,48***	0,15
	(3,08)	(1,46)	(4,34)	(2,32)	(4,30)	(1,37)
R squared	0,69	0,69	0,80	0,72	0,78	0,17

Regression results for Belgian stocks are presented in *Table 6.2.* There is no evidence for abnormal returns based on FF3 alphas, except the positive 0,66% unconditional alpha for portfolio 2. The unconditional factor coefficients prove that most of the return changes in sample portfolios can be explained by the three factors. TMNT portfolio has a positive β_{MKT} of 0,39 linking the changes in return difference of tradable and non-tradable firms with market returns changes. Still, the model explains TMNT returns of portfolios conclusively and there are no significant signs of abnormal returns during recession periods.

The CAPM regression shows similar results, with TMNT portfolio having no significant recession alpha nor other conditional factors. The market betas show monotonically growing pattern with 99,9 percent confidence interval, and TMNT also has a positive and significant β_{MKT} of 0,38.

Table 6.2 Factor model tests for tradability sorted portfolios in Belgium

Table 6.2 presents the regression results of factor models for tradability sorted portfolios for Belgian stocks. Conditional FF-3 is the three-factor model developed by Eugene F. Fama and Kenneth R. French (1992) CAPM the capital asset pricing model, conditionalized with terms equal to one during recession periods and zero otherwise. T-statistics are presented in the parenthesis. The confidence intervals are: ‘:90% level, *:95% level, **:99% level, ***:99,9% level.

	Belgium					
	NT	2	3	4	T	TMNT
	Conditional FF-3 (2000-2017)					
α	0,26	0,66*	0,02	0,15	-0,20	-0,47
	(0,86)	(2,03)	(0,06)	(0,53)	(-0,44)	(-0,89)
conditional α	-0,57	0,86	-0,39	-1,37	-1,19	-0,62
	(-0,63)	(0,89)	(-0,36)	(-1,57)	(-0,86)	(-0,40)
β MKT	0,78***	0,85***	0,98***	1,02***	1,17***	0,39***
	(12,68)	(12,84)	(13,37)	(17,16)	(12,42)	(3,67)
Conditional β MKT	0,05	0,17	0,05	-0,09	-0,05	-0,10
	(0,33)	(1,15)	(0,31)	(-0,67)	(-0,23)	(-0,40)
β SMB	0,40**	0,34*	0,51**	0,48***	0,57**	0,17
	(2,82)	(2,24)	(3,04)	(3,52)	(2,64)	(0,71)
Conditional β SMB	0,00	0,21	0,13	0,18	-0,18	-0,18
	(-0,01)	(0,52)	(0,29)	(0,51)	-(0,31)	-(0,27)
β HML	0,41***	0,29*	0,44**	0,44***	0,34*	-0,07
	(3,69)	(2,44)	(3,31)	(4,05)	(2,01)	(-0,36)
Conditional β HML	0,41	0,42	0,46	0,16	0,71	0,30
	(0,95)	(0,90)	(0,88)	(0,38)	(1,07)	(0,40)
R squared	0,58	0,58	0,60	0,69	0,54	0,08
	Conditional CAPM (2000-2017)					
α	0,59’	0,90**	0,39	0,51’	0,13	-0,46
	(1,89)	(2,80)	(1,06)	(1,69)	(0,27)	(-0,91)
conditional α	0,85	0,67	-0,69	-1,68’	-1,46	-0,61
	(-0,89)	(0,68)	(-0,62)	(-1,81)	(-1,03)	(-0,40)
β	0,79***	0,85***	0,99***	1,03***	1,17***	0,38***
	(12,43)	(12,78)	(13,05)	(16,48)	(12,29)	(3,62)
Conditional β	0,17	0,28*	0,19	0,00	0,13	-0,04
	(1,34)	(2,13)	(1,27)	(0,00)	(0,66)	(-0,21)
R squared	0,53	0,55	0,55	0,64	0,51	0,08

Table 6.3 presents the FF3 and CAPM regression results for French stocks. Four of the portfolios produced a statistically significant unconditional alpha with Fama-French 3 model. The conditional recession alphas are mainly (except portfolio 2 with 90% confidence interval) insignificant implying no return differences for portfolios not explained by FF3 factor during recession periods.

The CAPM regression for France provides some evidence in support for the hypothesis, as the TMNT portfolio produces a statistically significant (90% confidence interval) recession alpha on -1,23 percent a month or even -13,8 percent a year that cannot be explained with the model. During the whole sample period, the portfolios abnormal returns have been 0,54 percent a month or 6,6 percent a year. This indicates that French tradable sector clearly overperforms the non-tradable sector during expansion periods and underperforms during bad times. Returns of tradability sorted portfolios are cyclical, if with the weakest form of statistical confidence.

Table 6.3 *Factor model tests for tradability sorted portfolios in France*

Table 6.1 presents the regression results of factor models for tradability sorted portfolios for French stocks. Conditional FF-3 is the three-factor model developed by Eugene F. Fama and Kenneth R. French (1992) CAPM the capital asset pricing model, conditionalized with terms equal to one during recession periods and zero otherwise. T-statistics are presented in the parenthesis. The confidence intervals based on t-stats are: ‘:90% level, *:95% level, **:99% level, ***:99,9% level.

	France					
	NT	2	3	4	T	TMNT
Conditional FF-3 (2000-2017)						
α	0,24	0,71*	0,39’	0,30	0,64**	0,40’
	(1,17)	(2,59)	(1,95)	(1,43)	(2,69)	(1,66)
conditional α	0,85	1,49’	-0,02	0,41	-0,25	-1,10
	(1,37)	(1,82)	(-0,04)	(0,67)	(-0,35)	(-1,55)
β MKT	1,00***	1,22***	0,93***	1,14****	0,99***	0,00
	(23,70)	(22,01)	(22,57)	(27,17)	(20,67)	(-0,06)
Conditional β MKT	0,21*	-0,05	0,06	0,16’	-0,05	-0,26*
	(2,20)	(-0,39)	(0,68)	(1,72)	(-0,46)	(-2,39)
β SMB	0,41***	0,43***	0,30**	0,45***	0,80***	0,39***
	(4,28)	(3,41)	(3,16)	(4,68)	(7,24)	(3,49)
Conditional β SMB	-0,54*	0,06	-0,33	-0,18	-0,47	0,07
	(-2,12)	(0,18)	(-1,31)	(-0,71)	(-1,61)	(0,25)
β HML	0,20*	-0,31**	0,32***	0,52***	0,29***	0,10
	(2,57)	(3,12)	(4,27)	(6,85)	(3,37)	(1,12)
Conditional β HML	0,31	0,55	0,14	-0,30	0,14	-0,17
	(1,05)	(1,40)	(0,48)	(-1,03)	(0,41)	(-0,51)
R squared	0,82	0,76	0,80	0,85	0,76	0,12

Conditional CAPM (2000-2017)						
α	0,45*	0,65*	0,64**	0,70**	1,00***	0,54*
	(2,14)	(2,31)	(3,09)	(3,04)	(3,83)	(2,30)
conditional α	0,66	1,58’	-0,25	0,04	-0,57	-1,23’
	(1,01)	(1,85)	(-0,39)	(0,05)	(-0,72)	(-1,70)
β	0,99***	1,18***	0,93***	1,16***	0,98***	-0,02
	(22,68)	(20,44)	(21,84)	(24,60)	(18,21)	(-0,31)
Conditional β	0,30***	0,03	0,13	0,19’	0,04	-0,26**
	(3,39)	(0,29)	(1,50)	(1,97)	(0,37)	(-2,64)
R squared	0,79	0,73	0,77	0,81	0,69	0,05

4.4 Robustness tests

I perform robustness checks for the empirical patterns found in the study. Characteristics of tradability sorted portfolios are robust to the inclusion of imports in the tradability measurement: the portfolio changes remain rare when the tradability ratios are recalculated with imports as part of the tradability measurement. However, the GDP beta pattern disappears when using the alternative tradability ratios; I evaluate reasons for this in the last section (*5.1 Measuring tradability of output: Intra-EU vs Extra-EU measurements*).

4.4.1 Portfolio changes – including imports as part of tradability

As alternative way of measuring tradability, imports can be included to the calculation of tradability of industries. I used the definition of exports relative to the total output of the industries, as I am particularly interested in the tradability of companies output: it describes how the characteristics of firms output affects its stock prices during business cycles. However, excluding imports from the tradability measurement can be an issue if considerable number of firms have high level of imports compared to exports; these companies would mistakenly be classified as low-tradability ones and the characteristics of the industries they operate would not be fully taken into account. I calculate new tradability factors for each industry using the WIOD international supply and use tables as before (years 2002, 2005, 2008, 2011 and 2014) including imports and rebuild the portfolios. *Table 7* describes the portfolio changes of the companies between these two methods. As it can be seen, the companies mainly remain in the same portfolios as before, with all the portfolios having at least 75% of the original sample still with the new tradability measurement. Changes of larger than one portfolio do not occur. The measurement of tradability including only exports is robust.

Table *7 Portfolio shift probabilities including imports as part of tradability.*
Table 7 presents the portfolio transition probabilities when including imports as part of the tradability measurement. Original quantile ranks are presented in the horizontal axis and new ranks in the vertical axis.

		Exports				
		NT	2	3	4	T
Exports + imports	NT	0,88	0,15	0,00	0,00	0,00
	2	0,12	0,78	0,05	0,00	0,00
	3	0,00	0,08	0,85	0,07	0,02
	4	0,00	0,00	0,09	0,75	0,16
	T	0,00	0,00	0,00	0,19	0,82

4.4.2 GDP betas for tradability sorted portfolios – including imports as part of tradability

Table 8 *Cyclicality of tradability sorted portfolios*
Table 8 shows the GDP betas of tradability sorted portfolios, listed as before. GDP beta is the coefficient from regressing value weighted excess returns with explanatory variable of changes in real GDP in Euro area with an intercept term. Regression is done with quarterly figures. The confidence interval based on t-stats are: ‘:90% level, *:95% level, **:99% level, ***:99,9% level.

2000-2017	*NT*	*2*	*3*	*4*	*T*	TMNT
GDP β	2,73*	3,14*	2,71*	2,89*	1,27'	-1,46'
	(2,35)	(2,23)	(2,19)	(2,50)	(1,78)	(-1,92)

Table 8 shows the GDP betas for tradability sorted portfolios, including imports as part of the tradability measurement. All of the numbers are significant at some confidence interval. There is no increasing pattern in betas driven by tradability. Also, the TMNT portfolio returns correlate negatively with GDP, implicating an average of -1,46 percentage point decrease in returns when the GDP grows one percentage point. The results from robustness check are not robust to the original analysis, which is the most probably driven by the effect of intra-EU trading described in chapter *5.1 Measuring tradability of output: Intra-EU vs Extra-EU measurements*: including imports increases the proportion of trading to other EU member states in tradability measurement. This robustness check supports the conclusion that in the EU level sectors with high tradability are not exposed to international supply and demand shocks in member states, as the relative price mechanism equalizes the effects in aggregate level. Exports inside EU can be seen as domestic trading that is not dependent on the prices in foreign markets (outside EU).

4.4.3 Country-level portfolio changes – including imports as part of tradability

Table 9.1-9.3 show the results for country-level robustness test; I add imports as part of tradability as before for the whole sample regression analysis. The tables show the relative distribution of companies in new portfolios, with horizontal axis presenting the old portfolios for each company (*“exports”)* and vertical axis showing the new portfolios (exports + imports). We can see that the

tradability measurement is robust to inclusion of imports; the original portfolios retain most of the companies in every sample. Sample consisting of French stocks have the largest dispersion, as the firms in high-tradability portfolios (4 and T) hold on for around 56 percent of the original tradability quantiles with the new measurement. Nonetheless, the changes of more than one quantile remain low even in these portfolios, happening only for approximately 1 percent of the sample. On average, the new portfolios include 83 percent of the stocks from the export-only calculated portfolios.

Table 9.1 *Portfolio shift probabilities including imports as part of tradability – Germany.*
Table 9.1 presents the portfolio transition probabilities when including imports as part of the tradability measurement. Original quantile ranks are presented in the horizontal axis and new ranks in the vertical axis.

		Exports				
		NT	2	3	4	T
Exports + imports	NT	0,97	0,03	0,00	0,00	0,00
	2	0,03	0,88	0,07	0,00	0,00
	3	0,0	0,09	0,76	0,12	0,05
	4	0,00	0,00	0,11	0,80	0,09
	T	0,00	0,00	0,05	0,09	0,86

Table 9.2 *Portfolio shift probabilities including imports as part of tradability - Belgium.*
Table 9.2 presents the portfolio transition probabilities when including imports as part of the tradability measurement. Original quantile ranks are presented in the horizontal axis and new ranks in the vertical axis.

		Exports				
		NT	2	3	4	T
Exports + imports	NT	0,98	0,01	0,00	0,00	0,00
	2	0,02	0,99	0,00	0,00	0,00
	3	0,00	0,00	0,72	0,26	0,01
	4	0,00	0,00	0,28	0,72	0,00
	T	0,00	0,00	0,00	0,01	0,99

Table 9.3 *Portfolio shift probabilities including imports as part of tradability- France.*
Table 9.3 presents the portfolio transition probabilities when including imports as part of the tradability measurement. Original quantile ranks are presented in the horizontal axis and new ranks in the vertical axis.

		Exports				
		NT	2	3	4	T
Exports + imports	NT	0,92	0,92	0,00	0,00	0,00
	2	0,08	0,08	0,01	0,01	0,01
	3	0,00	0,00	0,74	0,04	0,19
	4	0,00	0,00	0,24	0,56	0,22
	T	0,00	0,00	0,02	0,38	0,57

5. Limitations to analysis

5.1 Measuring tradability of output: Intra-EU vs. Extra-EU measurements

As described in the chapter *"2.2 Theory and hypothesis",* the relative competitiveness of tradable and non-tradable sector fluctuates over positive and negative supply and demand shocks (i.e. business cycles) because of relative price adjustment mechanism. This phenomenon is the basis for evaluating stock returns and tradability patterns during business cycles. In the perspective of EU-level tradability, in theory the trading within European Single Market can be seen as domestic trading: the supply and demand of goods in markets outside EU do not affect directly to the relative price of the products. However, the tradability measurements calculated using WIOD's international supply and use tables take into account total exports by each country without separation between intra-EU and extra-EU exports. As a result, the industry tradability measures do not fully reflect the output exported outside EU, as the trade patterns can be very different (e.g. because of demand of foreign markets or free trade agreements). The correct method for measuring sector tradability in EU would be to separate intra-EU and extra-EU exports, which is difficult because the restrictions in data availability. An important conclusion from this study is that industries that export a lot of their output to other member states are not as exposed to foreign economic shocks as industries with global trading. Supporting this view, Gelleny (2001) found that cyclical economic factors do not influence intra-EU trading levels.

5.2 Sample period length for the time series regressions

In this paper, the analysis is done based on rather short time period (18 years), that includes only three recession periods and total of 24 recession months. The small number of recession periods reduces the statistical significance of the analysis. Sample period is limited due to lack of data in product segment sales and country level exports. The sales data for the three largest product segments in Datastream are mainly available starting from year 1999, and the WIOD's international supply and use tables date back to year 1995. As trade patterns change over time because of specialization, I estimate that using trade data not matching the sample period would have decreased the accuracy of tradability measurement. Tian (2018) also found that using old tradability data, the portfolio changes for tradability sorted portfolios increased significantly.

6. Conclusion

The main empirical finding of this paper is that stocks with high tradability ratios have more cyclical asset returns, but that they are driven mainly by common factors. Another finding is that on the view point of EU countries, tradable sector is found to be more exposed to business cycles and that the aggregate measurements don't reflect the trade patterns of member states.

The average returns increase in relation to tradability during expansion periods and decrease during recession. This indicates a strong and statistically significant link between tradability and business cycles but does not solely prove that the return patterns are not driven by other aspects, like the market, size or value factors. After controlling for Fama-French three-factor model and CAPM the empirical patterns can be mainly explained by common factors. In the factor model regressions, TMNT portfolios did not have significant results for the conditional alphas, that describe business cycle returns unable to be explained by the models.

Opposite to factor model testing, GDP coefficients provide a clear and reliable indication that tradable sector returns are more exposed to changes in economic growth. As a direct measurement of asset return cyclicality not dependent on the recession definition, GDP betas increase in relation to tradability. However, results from TMNT regression are not significant, and return difference between most tradable and non-tradable sectors cannot be linked in to business cycles.

Looking at the tradability's characteristics inside EU, the largest economies with considerable intra-EU trading show different results for asset price cyclicality. While there is no evidence supporting the hypothesis in German or Belgian markets, tradability can be linked to asset return cyclicality in France. The differences in export structures of member countries show that aggregate level calculations don't fully capture the tradability of sectors for EU as a domestic market, and country-level analysis is needed.

The results are partly very similar to Tian's (2018) study considering the U.S. markets, with portfolio means, factor model coefficients and GDP coefficients having similar results. Being in the center of cyclicality analysis, the most important difference is that statistical significance could not be found in aggregate level for TMNT portfolios in Europe. For future studies considering European markets, I suggest the measurement of tradability to be done based on extra-EU figures, in the limits of data availability. A further study with longer time period including more recession periods and a more detailed country-level study could help to understand the phenomena in Europe. Controlling the factor models and GDP coefficient for exchange rate exposure could also be used for more considerate analysis.

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Appendix

Appendice 1: ISIC Rev. 4 to SIC conversion table

ISIC Rev. 4	SIC Groups	Description
A01	01,02,07	Agriculture
A02	08	Forestry and logging
A03	09	Fishing, hunting, aquaculture
B	10,12,13,14	Mining
C10-C12	20,21	Manufacturing of food, beverages and tobacco products
C13-C15	22,23	Manufacture of textile products, aparrel
C16	24	Lumber and Wood Products, Except Furniture
C17	26	Manufacture of paper and paper products
C18	27	Printing and reproduction of recorded media
C19	29	Petroleum Refining and Related Industries
C20-22	28	Chemicals and Allied Products
C23	32	Manufacture of other non-metallic mineral products
C24	33	Manufacture of basic metals
C25	34	Fabricated metal products
C26	38, 39	Manufacture of computer, electronic and optical products
C27	36	Manufacture of electrical equipment
C28_30	37	Manufacture of transportation equipment
C31_C32	25	Manufacture of furniture
D35	49	Electricity, gas, steam supply
F	15,16,17	Construction
G45	75	Wholesale and retail trade and repair of motor vehicles
G46	50	Wholesale trade - durable goods
G47	52, 53, 54, 55, 56, 57, 58, 59	Retail trade
H49	40, 41, 42, 43	Land transport
H50	44	Water transport
H51	45, 47	Air transport
I	70	Accommodation services
J58	27	Publishing activities
J59_J60	78	Motion picture, programming and broadcasting activities
J61	48	Telecommunications
K64	60,61,62,67	Financial activities
K65	63,64	Insurance activities
L68	65	Real estate
M69_M70	81,83	Legal & social services
M71 & M73	87	Engineering, Accounting, Research & Management related services
M72		Scientific research
N	73, 89	Administrative & support service activities
O84	91, 92, 93, 94, 95, 96, 97, 98, 99	Public administration
P85	82	Education
Q	80	Health services
R_S	72, 76, 79, 84, 85, 86	Arts, entertainment and recreation + other services
T	88	Activities of households as employers

Appendice 2: Annual exchange for the country level sector tradability calculations

Country	***Acronym***	_2000	_2001	_2002	_2003	_2004	_2005	_2006	_2007	_2008	_2009	_2010	_2011	_2012	_2013	_2014
Austria	AUT	0,92	0,90	0,95	1,13	1,24	1,24	1,26	1,37	1,47	1,39	1,33	1,39	1,28	1,33	1,33
Belgium	BEL	0,92	0,90	0,95	1,13	1,24	1,24	1,26	1,37	1,47	1,39	1,33	1,39	1,28	1,33	1,33
Czech Republic	CZE	0,03	0,03	0,03	0,04	0,04	0,04	0,04	0,05	0,06	0,05	0,05	0,06	0,05	0,05	0,05
Germany	DEU	0,92	0,90	0,95	1,13	1,24	1,24	1,26	1,37	1,47	1,39	1,33	1,39	1,28	1,33	1,33
Denmark	DNK	0,12	0,12	0,13	0,15	0,17	0,17	0,17	0,18	0,20	0,19	0,18	0,19	0,17	0,18	0,18
Spain	ESP	0,92	0,90	0,95	1,13	1,24	1,24	1,26	1,37	1,47	1,39	1,33	1,39	1,28	1,33	1,33
Finland	FIN	0,92	0,90	0,95	1,13	1,24	1,24	1,26	1,37	1,47	1,39	1,33	1,39	1,28	1,33	1,33
France	FRA	0,92	0,90	0,95	1,13	1,24	1,24	1,26	1,37	1,47	1,39	1,33	1,39	1,28	1,33	1,33
United Kingdom	GBR	1,52	1,44	1,50	1,63	1,83	1,82	1,84	2,00	1,85	1,56	1,55	1,60	1,59	1,56	1,65
Greece	GRC	0,94	0,90	0,95	1,13	1,24	1,24	1,26	1,37	1,47	1,39	1,33	1,39	1,28	1,33	1,33
Hungary	HUN	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,01	0,01	0,00	0,00	0,01	0,00	0,00	0,00
Ireland	IRL	0,92	0,90	0,95	1,13	1,24	1,24	1,26	1,37	1,47	1,39	1,33	1,39	1,28	1,33	1,33
Italy	ITA	0,92	0,90	0,95	1,13	1,24	1,24	1,26	1,37	1,47	1,39	1,33	1,39	1,28	1,33	1,33
Luxembourg	LUX	0,92	0,90	0,95	1,13	1,24	1,24	1,26	1,37	1,47	1,39	1,33	1,39	1,28	1,33	1,33
Netherlands	NLD	0,92	0,90	0,95	1,13	1,24	1,24	1,26	1,37	1,47	1,39	1,33	1,39	1,28	1,33	1,33
Portugal	PRT	0,92	0,90	0,95	1,13	1,24	1,24	1,26	1,37	1,47	1,39	1,33	1,39	1,28	1,33	1,33
Slovenia	SVN	1,08	0,99	1,00	1,16	1,25	1,25	1,26	1,37	1,47	1,39	1,33	1,39	1,28	1,33	1,33
Sweden	SWE	0,11	0,10	0,10	0,12	0,14	0,13	0,14	0,15	0,15	0,13	0,14	0,15	0,15	0,15	0,15

Appendice 3: Time series regressions of tradability sorted portfolios

	NT	*2*	*3*	*4*	*T*	TMNT
	Conditional FF-3 (2000-2017)					
α	0,25	-0,04	0,22	0,38’	0,51	0,36
	(1,36)	(-0,15)	(1,14)	(1,76)	(1,62)	(0,99)
conditional α	0,31	0,45	-0,01	-0,41	0,25	0,03
	(0,37)	(0,47)	(-0,14)	(0,64)	(0,12)	(0,01)
β MKT	0,88***	1,12***	0,92***	0,95***	1,18***	0,30***
	(23,50)	(20,74)	(22,10)	(21,72)	(18,37)	(4,12)
Conditional β MKT	0,15	-0,17	-0,05	0,13	0,12	-0,03
	(1,62)	(-1,34)	(-0,46)	(1,24)	(0,78)	(-0,18)
β SMB	-0,07	-0,37**	-0,21	-0,35***	-0,56***	-0,49**
	(-0,91)	(-3,12)	(-2,37)*	(-3,62)	(-4,04)	(-3,07)
Conditional β SMB	0,01	-0,02	0,00	-0,00	0,00	-0,02
	(1,15)	(-0,934)	(0,28)	(-0,20)	(-0,02)	(-0,64)
β HML	0,14*	-0,74***	0,18*	-0,07	-0,01	-0,15

	(2,01)	(-7,523)	(2,39)	(-0,90)	(-0,09)	(-1,12)
Conditional β HML	0,17	0,95*	0,08	0,33	0,14	-0,01
	0,63	(2,469)	(0,28)	(1,04)	(0,32)	(-0,03)
R^2						
	Conditional CAPM (2000-2017)					
α	0,29	-0,52*	0,27	0,26	0,37	0,17
	(1,62)	(-1,77)	(1,33)	(1,20)	(1,16)	(0,48)
conditional α	0,24	0,96	-0,06	-0,28	0,38	0,23
	(0,44)	(1,07)	(-0,09)	(-0,43)	(0,38)	(0,21)
β	0,89***	1,09***	0,94***	0,97***	1,2***	0,31***
	(23,86)	(17,94)	(22,41)	(21,72)	(18,46)	(4,23)
Conditional β	0,16*	-0,08	-0,03	0,17’	0,11	-0,04
	(2,08)	(-0,65)	(-0,41)	(1,82)	(0,85)	(-0,32)